Simulation support for Task B

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Tasks for simulation group

- Review list of ECMs
  - Which tool(s) to use for each ECM/building type (probably EnergyPlus, ESP-r, TRNSYS)
  - What is implied by each ECM
    - What level of detail
    - What holistic measures of performance can be delivered
    - What other issues might this impact

Scope of the study

- What regions should be included?
  - Implies architectural variants
    - different construction details and construction materials
    - different patterns of building use and environmental controls
  - What regional climates to include?
    - Coverage vs complexity of assessments vs size of the database

Scope of the study

- What building types should be included?
  - Mix of buildings should be a win-win for all member countries
  - Buildings should be both ubiquitous, and not extensively covered in other IEA projects
  - What architectural epochs might be considered?
  - What regional variants of each building type that might be included?
- What portions of each building type are of interest
  - Selection criteria to be resolved

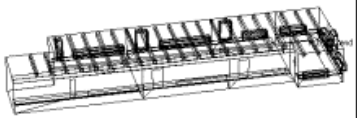
Methodology

- Early emphasis on planning
  - Methodology for selecting regions
  - Methodology for selecting building types and architectural epochs
  - Methodology for creating matrix of building/ECM pairs
  - Methodology for weighing benefits of ECM
  - Work with Task D on contents and communications with database
  - Pilot study using range of tools to evolve approach
  - Early deliverables to the Annex

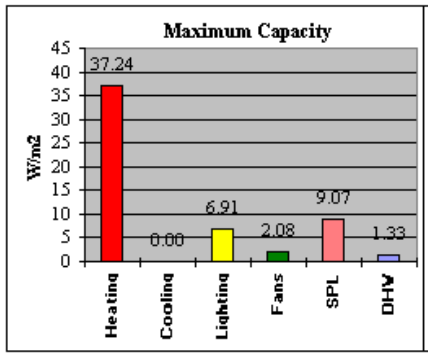
- What does our audience want to know?
  - Today's tools can address scores of issues
  - The tools available in 2007 will support even more retrofit issues
- Holistic is in the Annex title. That suggests multi-criteria assessments
  - Each ECM could be judged on different criteria
  - Unintended consequences must be captured
  - Weightings between performance issues - a deliverable or a user choice?

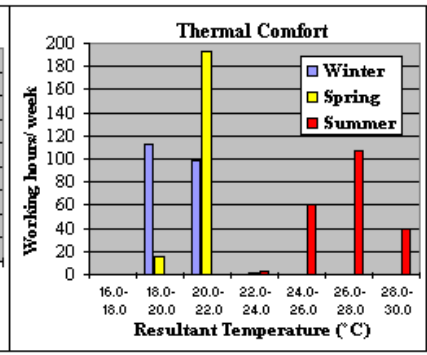
Queens Building

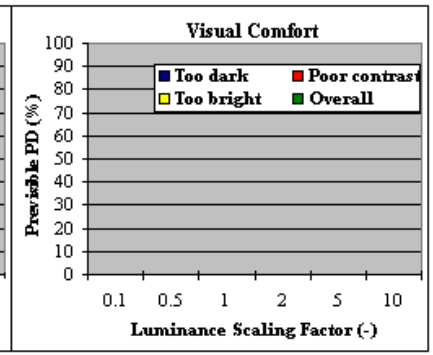
Version: Reference
Contact: dle@esru.strath.ac.uk
Date: Aug-97

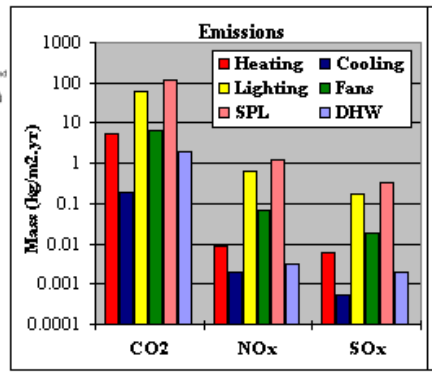


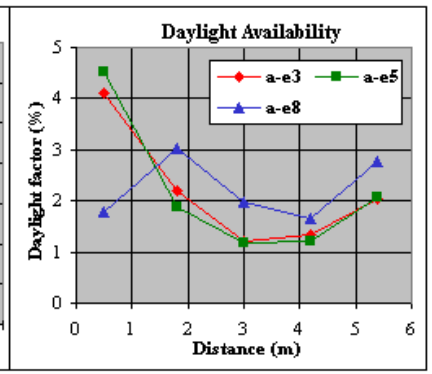
Electrical laboratory wing in Queens Building of De Montford University. Reference model without lightshelves and with timed switching of lighting. Conventional facade to courtyard.











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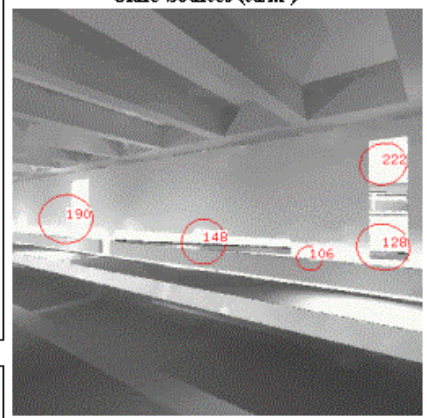
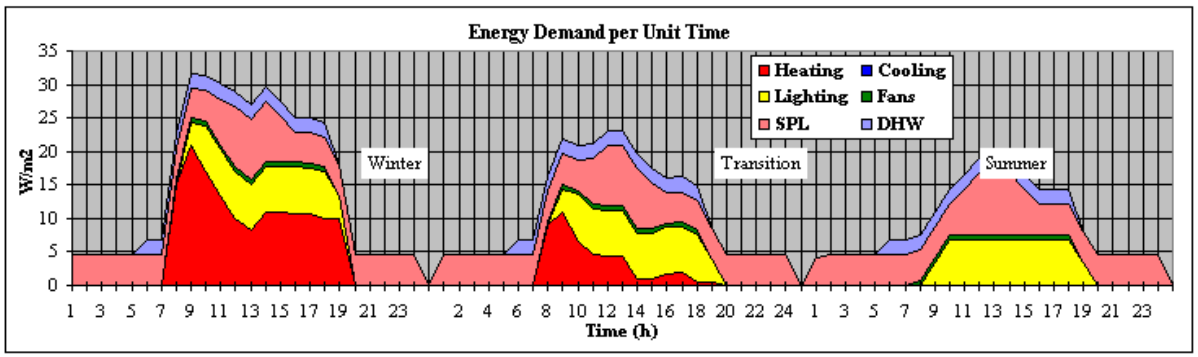


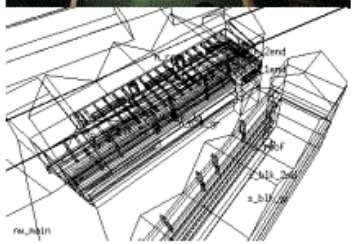


Annual Energy Performance

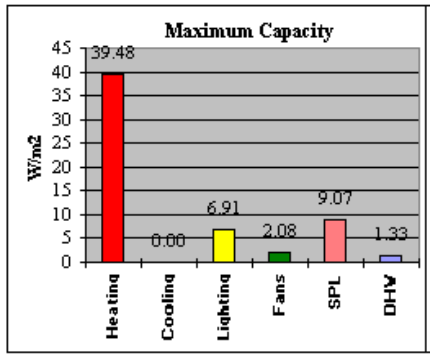
Heating:	23.41 kWh/m^2.a
Cooling:	0.07 kWh/m^2.a
Lighting:	22.64 kWh/m^2.a
Fans:	2.53 kWh/m^2.a
Small PL:	45.28 kWh/m^2.a
DHW:	9.71 kWh/m^2.a
Total:	**103.64 kWh/m^2.a**

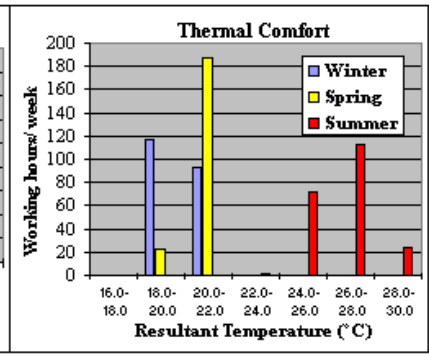
Queens Building

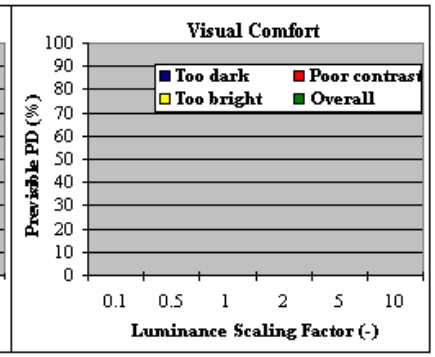
Version: No lightshelves
Contact: dle@esru.strath.ac.uk
Date: Aug-97

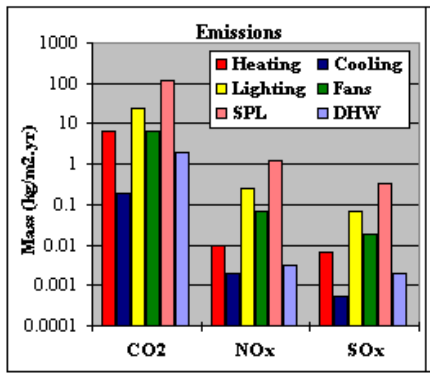


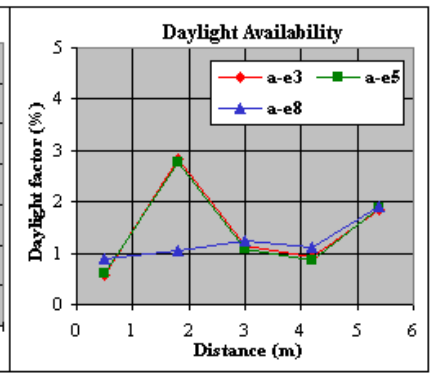
Electrical laboratory wing in Queens Building of De Montford University. Reference with no lightshelves, light switching and average coloured courtyard.











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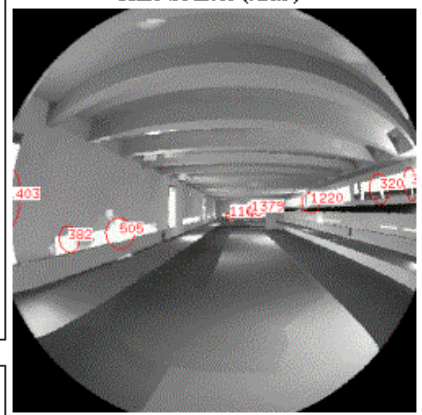
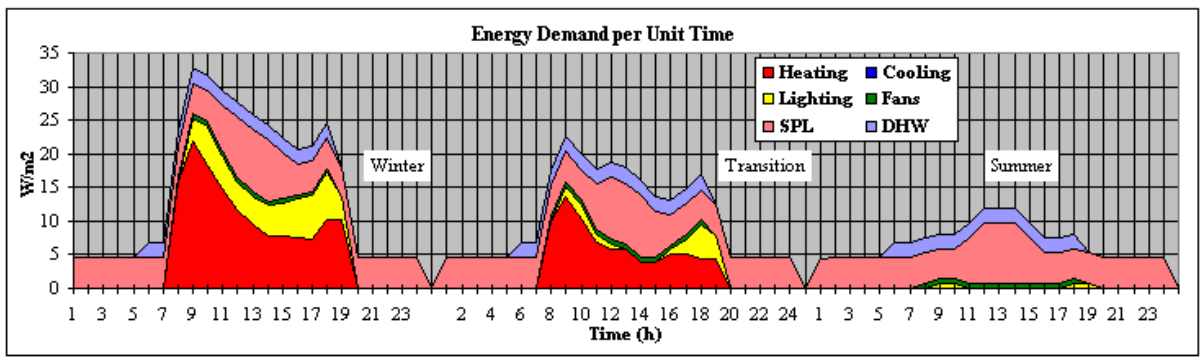


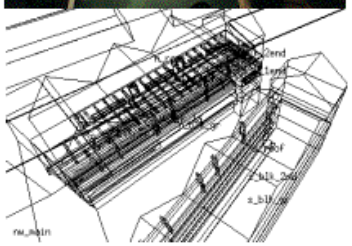


Annual Energy Performance

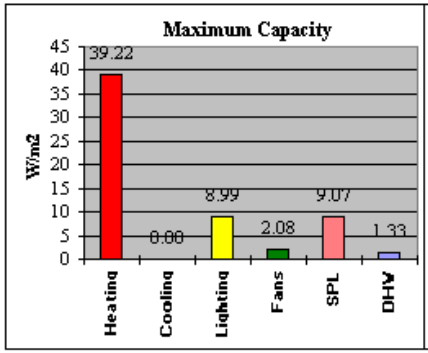
Heating:	26.70 kWh/m^2.a
Cooling:	0.07 kWh/m^2.a
Lighting:	9.02 kWh/m^2.a
Fans:	2.53 kWh/m^2.a
Small PL:	45.28 kWh/m^2.a
DHW:	9.71 kWh/m^2.a
Total:	**93.30 kWh/m^2.a**

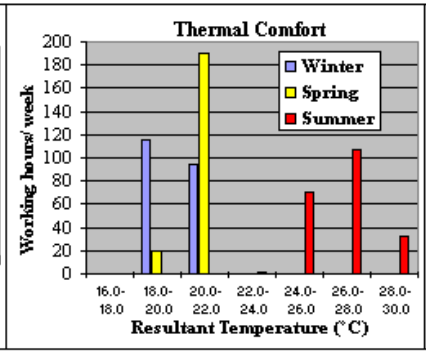
Queens Building

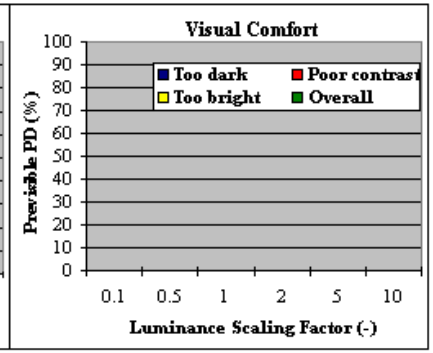
Version: Blinds added
Contact: dle@esru.strath.ac.uk
Date: Aug-97

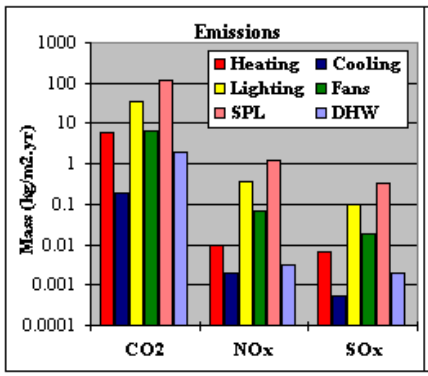


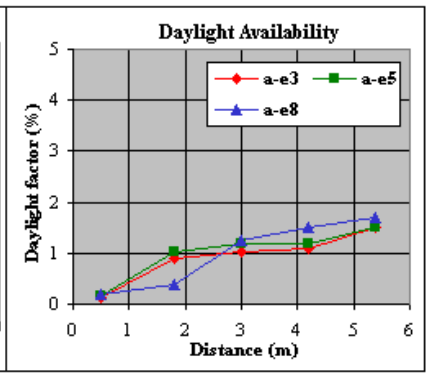
Electrical laboratory wing in Queens Building of De Montford University. Includes lightshelves, light switching and average coloured courtyard. Blinds added to control glare.











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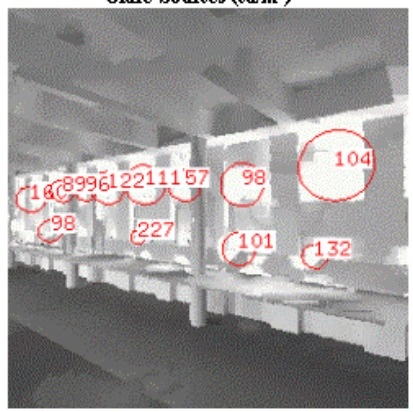

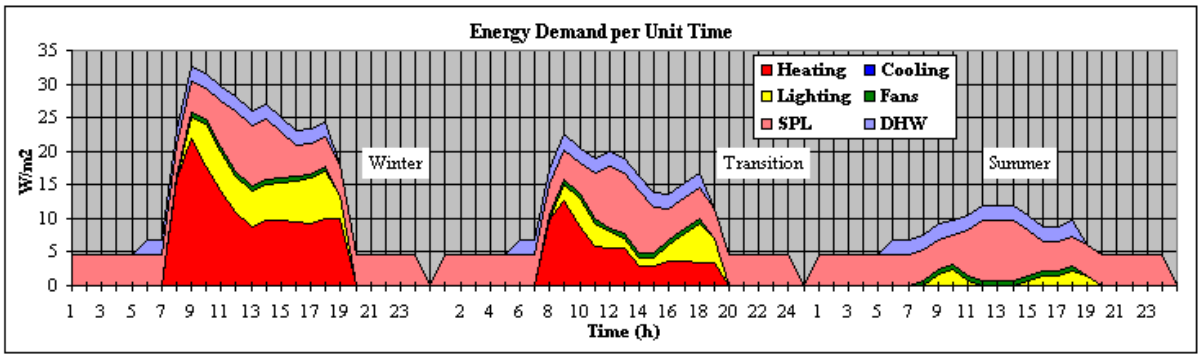

Annual Energy Performance

Heating:	25.80 kWh/m^2.a
Cooling:	0.07 kWh/m^2.a
Lighting:	13.02 kWh/m^2.a
Fans:	2.53 kWh/m^2.a
Small PL:	45.28 kWh/m^2.a
DHW:	9.71 kWh/m^2.a
Total:	**96.40 kWh/m^2.a**

Sub-task B will…

- Propose a list of holistic performance issues for each building/ room type/ ECM
  - Trade-offs between capacity and energy demands over time
  - Trade-offs between renovation cost and life cycle costs
  - Trade-offs between visual / thermal / acoustic
  - Impact of occupant / small power density
  - ??

Sub-task B work

- Propose a list of building types and applicable room types for each ECM
  - Building types should be applicable to Annex member countries
  - Building types will probably be ubiquitous and, hopefully, not the subject of other IEA work
  - Each building type is envisaged to have a limited number of regional variants
  - Each building type is envisaged to have variants which address architectural epochs
  - Some design questions relate to rooms which do not have a specific building context and thus can be treated in isolation

Building types

- Initial proposals
  - Archives and warehouses
  - Engineering laboratories
  - Detention facilities
  - Libraries
  - Maintenance facilities
  - Office accommodation

Building types

- Archives and warehouses
  - Governments hoard documents and artifacts which require specific environmental conditions. Characterized by large volumes, high internal mass, limited access
  - Warehouses have different requirements on environmental conditions. Also characterized by large volumes, high internal mass, intermittent access
  - Propose an archive for artifacts with a mix of spaces and typical control regimes

Building types

- Engineering laboratories
  - Most governments have facilities for undertaking civil & marine & materials engineering research
  - Characterized by mix of large spaces and specialist labs (e.g. clean rooms)
  - Mixed expectations for environmental control
  - Propose a model including large spaces and smaller labs with range of controls.

Building types

- Detention facilities
  - Governments construct and most operate detention facilities
  - The stock of buildings tends to be older
  - Characterized by a few large spaces and numerous small rooms. There are definite regional variants and architectural epochs.
  - Propose models of a cell-block wing (accounting for regional variants)

Building types

- Libraries
  - Combines issues of archive with public access and education
  - Technology is altering the nature of such facilities and there is considerable risk in clash of demands and in unintended consequences of technology
  - Propose one section/wing of a library from two epochs

Building types

- Maintenance facilities
  - Prior work (for CERL) might be re-cast for the needs of this Annex
  - Should focus on one or two designs which are applicable across many regions

Building types

- Office accommodation
  - Certainly ubiquitous
  - However the subject of prior IEA work
  - And the classification is diffuse & covers many epochs and design variants and regional issues
  - Propose to delay work on this type.
  - One approach might be typical rooms and/or room clusters to keep within the resources of the Annex

ECM

- Task B will work to clarify the specifics of each ECM -
  - level of detail required for modeling
  - credible approaches to modeling,
  - current best practice and trends in best practice
  - what performance indicators simulation can deliver
  - which building types and room types are candidates
- The resulting matrix passed to other Tasks for comment

Cooperative working

- Task B will work with other task groups to clarify:
  - Regions of the world to be included
  - Regional construction methods and materials
  - Architectural details for agreed epochs and locations
  - Background and assumptions for each ECM
  - Ideas on performance metrics (we know this works because…)
  - Interactions with the toolkit
  - Approval on the matrix of assessments

Towards 2007-8

- Tools are evolving…
  - Setting up 10,000 runs used to be something to brag about (and charge money for)
  - Simulation used to be guarded over by an elite of simulationists.
- Where will simulation be in 2-3 years?
  - We might begin by looking at just who is using simulation the most, what interface they are using and how long it take them to compose their questions and get a response….
  - Remembering that computers are getting faster and networks are getting faster and simulation tools are evolving every month….

- Guess who uses simulation most?
  - Householders in Canada who are looking for advise, and they don't even know they are using simulation.
  - They get advise on most types of housing constructed over the last 100 years in all parts of Canada (say about 60 places) with dozens of ways of heating and cooling.
  - And they take a few minutes describing their home
  - And they get answers in about a minute based on a freshly created model of their home and and assessments run for them.
  - The web is their interface.
  - Where are the simulations run - some compute server someplace.
  - And then they try something a bit different (from a few dozen different possible technologies and retrofits) and see if one of them or a combination of options works better.

Reality check…

- So *what is this tool that the Annex is going to produce three years from now.*
- Is our current view of *how to distribute information* going to be relevant three years from now?
- Can we imagine today what will confront our audience in 2007-8?
- What might their expectations be?

- Of course…
  - New issues will arise
  - Building codes will evolve
  - Health and safety regulations will evolve
  - Older buildings will be repurposed
  - Energy costs will double or they might be cut in half

An informed guess…

- there is a good chance, that in three years someone will have created the infrastructure needed to respond to ad-hoc questions in near real time on any computer.